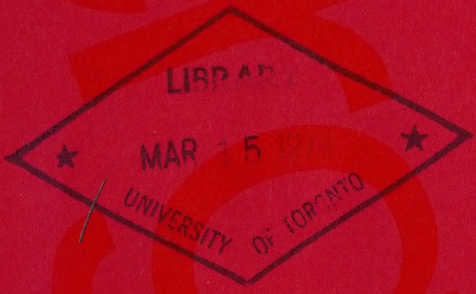
ontario hydro



-concerns of the 70's

Five hundred tons of garbage will be burned daily in a two-year test program at Lakeview generating station, just west of Toronto.

Energy makes the world go around.

It's needed to light and heat homes, stores, offices and industries...to produce food and manufactured goods...and to drive cars, trucks, farm tractors, buses, trains and ships.

What's more, if fuel shortages occur in Canada or in countries to which we sell our products, our way of life may be affected in many ways.

The federal government is making strenuous efforts to supply eastern Canada with oil. But emergency measures may be not enough to meet the needs of Canadians who live east of Montreal.

Energy Minister Darcy McKeough has suggested that Ontario may have to share some of its fuel with its neighbors. In view of the uncertain outlook, appeals to conserve energy have been made by the Provincial Government and by federal authorities in Ottawa.

These appeals are in line with Ontario Hydro's advertising, introduced before the present energy crisis, which stresses the need for wise and efficient use of all forms of energy, including electricity.

Electricity is one of the most versatile and flexible forms of energy but, except in small quantities, it cannot be stored and must be used as it is produced. Yet electricity is still the best way of providing massive amounts of energy to population centres.

This booklet discusses Ontario Hydro's program to produce enough electric energy to meet Ontario's needs in the light of world fuel shortages.

need to conserve

Ontario Hydro has adequate capacity to generate the electricity required by the province at present and to help hard-pressed neighboring utility systems in the Northeastern United States.

Why, then, is Hydro urging conservation? Part of the answer is that the possiblity of long-term shortages of fuel was foreseen long before the Middle East war. But there are other reasons as well.

Electricity demands double every 10 years in Ontario. As a result, Hydro must build large new stations and transmission lines which cost billions of dollars. Thus it's desirable to promote efficient use of electricity to ensure this money is wisely

spent and to minimize the impact of new facilities on the environment.

In addition, coal, gas and oil are non-renewable resources that must be husbanded to provide for future needs of fuel and a wide range of products made from petrochemicals. One way of doing so is to avoid wasting any form of energy and to discover ways to use it as wisely as possible.

Fuel shortages in Canada and other countries have merely accentuated the long-term need to conserve energy.

generation mix

At present, Ontario Hydro has an installed generating capacity of 16,600 megawatts. A megawatt is equal to one million watts — enough energy to supply the peak power demands of about 300 modern homes — and equal to the power output of 50 large automobiles travelling at 50 miles an hour.

Of this capacity, Hydro derives 39 per cent from 68 hydro-electric stations, 45 per cent from six fossil-fuel stations, 14 per cent from three nuclear stations, and 2 per cent from oil-fired combustion turbine units*.

A megawatt consumed for one hour is known as a megawatt-hour. In 1972, Hydro made available 80 million megawatt-hours of electric energy from the above sources. Of that amount, 47 per cent came from hydro-electric stations, 32 per cent from fossil-fuel plants and 7 per cent from nuclear sources.

Years ago, Hydro generated virtually all its energy in hydro-electric stations. But a transition has been taking place to fossil and nuclear fuels. Each year, Hydro now purchases 8.5 million tons of coal, 15 million gallons of oil, 49 billion cubic feet of natural gas and 340 tons of nuclear fuel at a cost of $147 million.

Hydro's shopping list for fuels will grow within the next five years to operate existing plants and new stations under construction. By then, annual

* Oil-fired combustion turbines are stand-by units which are used sparingly to meet peak demands. Because they are expensive sources of energy, they are generally used only in emergencies.

requirements are expected to include 12 million tons of coal, 295 million gallons of oil and 567 tons of uranium. The annual cost depends on rising fuel prices, but it is has been estimated at more than $300 million.

Hydro serves about 2.5 million customers in the province. Residential customers use 26 per cent of the megawatt-hours, industrial customers 42 per cent, general commercial customers 29 per cent and farms 3 per cent.

expansion program

Hydro is building or planning to build generating facilities which will provide more than 16,000 megawatts of new capacity in the next 10 years. This will be equivalent to all the generating facilities Hydro has built in the past six decades.

The expansion program is designed to meet power demands which are expected to reach 25,000 megawatts by the early 1980's.

Work in progress includes the 3,200-megawatt Bruce nuclear power station, the 4,000-megawatt coal-fired plant at Nanticoke and the 2,295-megawatt Lennox station, first Hydro station designed to burn oil to generate power.

In 1973, the provincial government approved in principle the construction of additional facilities. These include the doubling of the Pickering and Bruce nuclear stations, a large plant at Wesleyville, near Port Hope, and Darlington nuclear station, near Bowmanville. Additional generating capacity will also be required in Northern Ontario in the late 1970's.

The Wesleyville plant was originally planned to be oil-fired. Now, because of the changing supply picture, use of oil at both Wesleyville and Lennox is under review. Details on oil supplies are given in an ensuing section.

By 1982, nearly one-third of Hydro's generating capacity will be nuclear and about one-half will come from fossil fuels.

future demands

Forecasts of future power demands are difficult to make. This is particularly true when there are possible shortages of other forms of energy.

What would be the effect on Hydro if many fuel-starved households started using portable

electric heaters and electric blankets? It is conceivable that Hydro might have difficulty meeting a sharp increase in demand for electricity.

One thing is certain. Hydro requires up to 10 years to design and build a new generating station. The possibility of an unexpected upsurge in demands suggests another reason for the wise use of electricity.

heavy water

Heavy water is an essential ingredient in Canadian nuclear-electric stations which are fuelled with natural uranium. It is used as a moderator to start and sustain the atom-splitting process inside the reactor and to transport heat from the fuel to the steam generators.

Two heavy water plants are in operation in Canada — a Canadian General Electric plant in Nova Scotia and the Bruce heavy water plant on Lake Huron at Douglas Point. A third plant, located at Glace Bay, N.S., is being rebuilt and is expected to be in operation in 1975.

To ensure additional heavy water supplies for Ontario, Hydro has purchased the Bruce plant from Atomic Energy of Canada Limited and plans to increase its capacity.

Late in 1973, the federal government announced that a new 800-ton-a-year heavy water plant will be built at Gentilly, Quebec.

Additional facilities will be required to meet Hydro's expanding needs and to supply other Candu reactors in Canada and abroad.

alternative sources

Water power has been the traditional source of electricity in Ontario. But since 1951, when the first coal-fired generating unit came into service, Hydro has been gradually changing its fuel mix and now uses all three fossil fuels - coal, oil and natural gas — and uranium.

Hydro has investigated the possible use of lignite, a low-grade coal found in Northern Ontario, and is planning to burn garbage mixed with coal to produce electricity at its Lakeview station.

Water power represents nearly two-fifths of Hydro's present resources. But the proportion is steadily declining with the transition to thermal-electric generation.

water power

Since the early years of this century, more than 6,000 megawatts of hydro-electric capacity have been developed in Ontario. This represents nearly two-fifths of Hydro's present generating resources. But the proportion has been declining in recent years and will continue to do so with the transition to thermal-electric sources.

An additional 1,500 megawatts could perhaps be developed, but the sites are located mainly in remote parts of Northern Ontario. These sites, located on rivers with relatively low flows, are primarily suitable for meeting peak demands for a few hours a day. But under present conditions, Hydro will probably not need additional peaking capacity before 1978.

The feasibility of developing these sites depends mainly on the cost of developing equal amounts of power from fossil fuels or uranium. Other factors include transmission-line costs and

the prevailing interest rate for borrowed funds.

At present, supplies of fossil fuels and their cost are uncertain. Further hydro-electric development will depend on changing circumstances. Construction of a 78-megawatt plant is under way on the Madawaska River near Arnprior mainly to control fluctuations in water levels and erosion caused by upstream plants.

Pumped storage sites with a potential of several thousand megawatts are long-range possibilities at Delphi Point on Georgian Bay and at Jordan in the Niagara Peninsula. In such plants, power is used to pump water into a reservoir; the water is then released to spin the turbines during periods of peak demands.

Hydro has a large pumped storage station at Niagara Falls. New projects will depend, in part, on the availability of low-cost nuclear power to pump water during off-peak hours.

Hydro is taking a new look at possible hydro-electric developments in view of the changing fuel picture.

uranium

Use of uranium reduces Ontario's reliance on imported fossil fuels to generate electricity. Without nuclear power, Ontario Hydro's consumption of coal, mostly imported from the United States, would climb in the next decade to 25 million tons costing more than $300 million a year.

Uranium is a concentrated form of energy. Pickering generating station's four reactors contain 464 tons of uranium, which is equal to 9 million tons of coal, or enough to fill about 120,000 railway cars. A pound of natural uranium produces 29,000 kilowatt-hours, compared with 1.5 for a pound of coal or 2 kilowatt-hours for a pound of oil.

In 1972, the Pickering station produced the equivalent in energy of about 2,000,000 tons of coal. The use of nuclear fuel also alleviates air pollution produced by coal-fired stations, particularly in the Toronto area.

A growing advantage of nuclear power is that fuel becomes only a small part of the cost of producing electricity and uranium prices are relatively stable. Meanwhile, the costs of fossil fuels have risen sharply in recent years and, with

expected shortages in world supplies, they are expected to rise even higher.

Ontario lacks sufficient supplies of fossil fuels for its needs, but has large deposits of uranium. To support its expanding nuclear reactor program, Hydro will require increasing amounts of fuel at a time when world demands for uranium are increasing. By 1990, nuclear power is expected to be generating at least 50 per cent of the province's electric energy.

In reviewing the outlook for nuclear power in Ontario, the Ontario Advisory Committee on Energy urged renewed exploration on a substantial scale to locate more reserves of uranium.

Despite the advantages, there are important reasons why at this time Hydro cannot turn exclusively to nuclear power.

Firstly, supplies of heavy water are not expected to permit any greater commitment to nuclear power than has already been made. Secondly, although the performance of Pickering has been outstanding, nuclear experience has been limited in comparison with fossil-fuel technology and Hydro cannot afford to overcommit itself in any one direction.

In addition, nuclear plants are most efficient as base-load plants which supply power continuously. Fossil-fuelled plants are more economical for meeting peak demands. Power systems need both types of plant to meet the fluctuating demands of their customers.

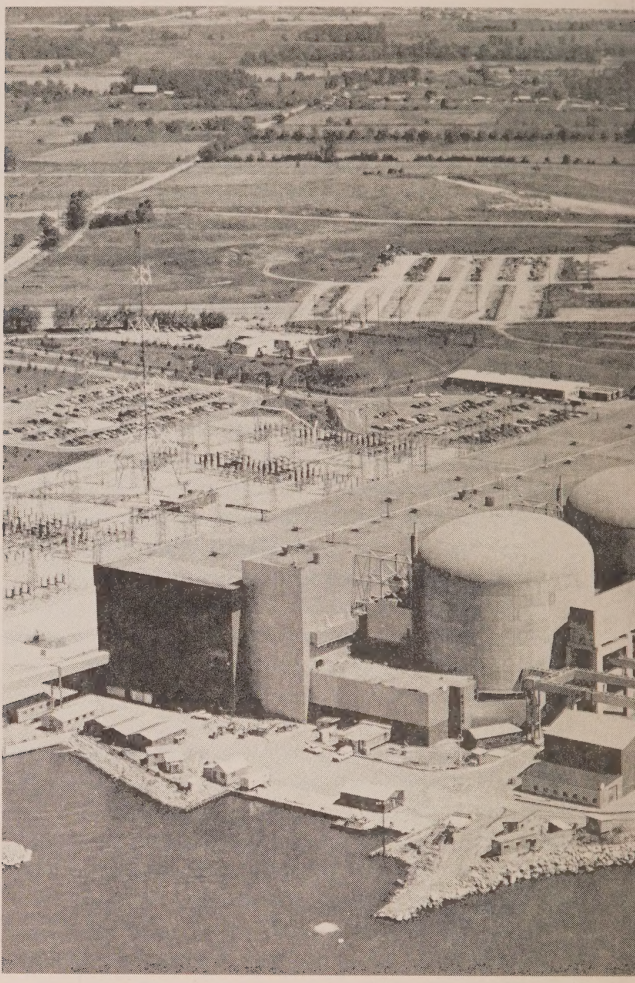
coal

Coal is Canada's most abundant fossil fuel. More than 90 per cent of reserves, however, are located in Western Canada, about 2,000 miles from Ontario markets. As a result, Ontario imports two-thirds of its requirements from the United States.

Use of unit trains and self-unloading coal carriers reduces transportation costs and makes U.S. fuel an economical choice for Hydro's six coal-fired stations. The present capacity of these plants is 7,100 megawatts, but it will increase by 2,500 megawatts when the Nanticoke station is completed in 1977.

However, the economic picture has been changing in recent years. U.S. coal prices have risen from $9 to $12.50 a ton and will probably go

Pickering generating station's four reactors contain more than 460 tons of uranium. In terms of energy, that's equal to 9 million tons of coal.



higher. Pickering Generating Station has proved to be an outstanding success and, at the same time, has shown nuclear-electric power to be competitive with fossil-fuel plants.

Hydro purchases U.S. coal on long-term contracts and continuous supplies from American mines seem assured. But Hydro is concerned about its heavy reliance on imported fuel, particularly in view of the U.S. energy shortage.

A number of U.S. power stations, unable to get sufficient oil, are expected to change over to coal. Although the U.S. has abundant supplies —

enough to last 300 to 400 years — the mining industry faces demands which now exceed production, and shortages are expected.

For these reasons, Hydro is taking a closer look at Western Canadian coal despite the long, costly rail haul. During 1974, Hydro plans to purchase up to 500,000 tons of British Columbia and Alberta coal to test its qualities in Ontario plants. The test program will include rail transport to Thunder Bay, shipment by lake vessels to Hydro stations, and experimental burning.

lignite

Ontario depends on fuel imports for 80 per cent of its energy requirements. Although the province has only small supplies of oil and natural gas, there is a large deposit of low-grade coal called lignite in Northeastern Ontario.

The lignite deposit, located at Onakawana about 60 miles south of James Bay, is estimated to contain at least 170 million tons, but it has never been thoroughly explored. Lignite is also found in Saskatchewan where it is used to generate electricity.

Ontario Hydro has conducted burning tests of lignite at its Thunder Bay plant. The Onakawana lignite has less than half of the heat content of the imported coal burned in Hydro stations and contains approximately 48 per cent moisture.

Ontario's Advisory Committee on Energy says that over the long term, Onakawana lignite could be used to produce electric power at the site or as a source of pipeline gas.

Problems associated with lignite include the high costs of transporting it because of the water content or of transmitting power from the remote site.

However, the economics of any particular source of energy can change quickly and a fresh look is being taken at the possibility of using Ontario lignite in view of the energy situation.

natural gas

The Richard L. Hearn station, located on the Toronto waterfront, is Hydro's only thermal-electric plant burning natural gas.

The plant was converted from coal to natural gas several years ago to reduce air pollution in the Toronto area.

Natural gas is a clean-burning fuel with practically no sulphur content, but supplies are limited. The Hearn plant consumes as much gas as all of Metro Toronto. One of the larger 200-megawatt units may use as much as two million cubic feet an hour — enough to supply the average home for about 12 years.

As another air quality measure, the Hearn station is equipped with a 700-foot chimney, completed in 1971, at a cost of $9 million. The

Nanticoke generating station, on Lake Erie, will consume about 190 tons of coal an hour when operating at full capacity.

giant stack discharges flue gases high into the atmosphere where they are rapidly dispersed, thereby reducing pollution at ground level.

Four of the plant's eight units have been modified to burn either gas or coal, or a combination of both.

oil

Because of the energy crisis, the choice of oil for two Hydro thermal-electric stations is under review and some other fuel may have to be selected.

Lennox generating station, Hydro's first oil-fired plant, is nearing completion near Kingston. The first unit is scheduled to start up in 1975. Two additional units are scheduled for service in 1976 and a fourth unit in 1977.

Hydro has contracted for oil to be imported from Venezuela and Libya to supply Lennox. Crude oil, delivered by tanker to Quebec City, would be processed in a refinery to remove petroleum products. The heavy residual oil would be transported to the station on 50- to 70-car unit trains.

At the time of the Lennox decision in 1969, oil was cheaper than coal and readily available. Savings in capital costs of building the 2,295-megawatt station were estimated at $20 million.

In June 1973, Hydro announced plans for a second oil-fired plant at Wesleyville, near Port Hope. Whatever the choice of fuel, preliminary work is scheduled to start in 1974.

Use of oil to generate electricity would permit Hydro to further diversify its fuel needs, reduce its reliance on imported coal, and meet power demands until sufficient nuclear-electric facilities can be developed.

Even if fuel is readily available, cost is an important consideration. During its lifetime, a conventional thermal-electric plant will consume fuel worth more than the total capital cost of the plant.

watts from waste

Hydro will play a key role in a "Watts from Waste" project that will convert Metro Toronto garbage into electricity at Lakeview Generating Station.

Starting in 1976 or 1977 for a two-year trial

period, the station will consume 500 tons of garbage a day in one of its eight 300-megawatt units.

Shredded refuse, from which metal and glass have been separated at a new processing plant, will be mixed with coal and fed into one of the Lakeview furnaces.

A study team appointed by the Ministry of the Environment has estimated that the station could ultimately burn 10 per cent of Metro's Toronto garbage, which now amounts to about 1,600,000 tons a year.

transmission lines

Transmission lines are essential links between power stations and customers. Existing lines have limited capacity and unless new circuits are built, some power could be locked inside Hydro's new generating stations when it's needed. No way of delivering their full electrical output would exist.

Hydro's transmission network consists of approximately 14,000 miles of 115-, 230- and 500-kilovolt lines. A kilovolt (kV) is 1,000 volts.

Over the next five years, Hydro hopes to build another 1,000 circuit miles of twin-circuit 500-kV line. Additional 230-kV and 115-kV lines will be required as well as a number of new transformer stations.

On new power line routes, trees are being selectively cut, road crossings screened with trees and, in some locations, better-looking towers are being installed. Transformer stations will have equipment with improved appearance and extensive landscaping.

Hydro is committed to public participation in deciding on line routes and has been holding meetings with municipal councils, planning boards, conservation authorities and members of the public to hear their views.

But Hydro is becoming concerned with delays in getting approvals to start construction. A proposed 500-kV line between Nanticoke and Pickering has been held up several years for this reason.

Extended delays in building transmission lines will cost millions of dollars and increase the risks of power interruptions or shortages in the late 1970's.

energy and the environment

Can we have abundant energy and preserve the environment, too? This topic is being continually debated but many agree that it would be unfortunate if progress in controlling pollution were abandoned to solve fuel shortages. Pollution control is still an important objective.

Energy use and pollution are closely linked. Waste of energy often leads to air and water pollution. Waste of resources such as metals leads to scarcity, disposal problems and more intensive mining of the earth's crust to find more minerals.

It's becoming clear that environmental programs should be balanced against the need for energy. The U.S. is finding that it's necessary to relax pollution controls because of fuel shortages. On the positive side, it may give the U.S. time to develop better methods of controlling pollution or to devise more efficient ways of using fuel.

Closer to home, Ontario has more leeway in planning to balance our environmental and energy needs. Hydro has spent or committed $74 million to control air pollution at fossil-fuelled plants and has a wide-ranging program to protect the environment and to minimize unsightly intrusions into the landscape.

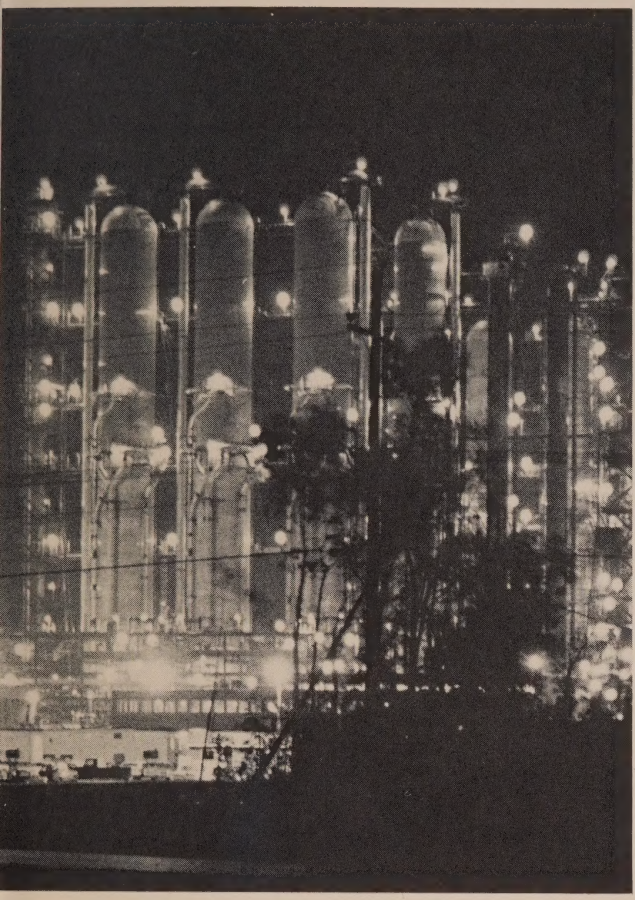
a long-term view

Taking a long-term view, it is becoming necessary to conserve not only fuels but a whole range of materials. Some metals, like aluminum, have a large energy component. If such products are discarded after use, we are in effect wasting energy. Plastics and a wide range of consumer goods are made from oil, a non-renewable resource.

We can't afford to be a throw-away society, but must make more efficient use of all forms of energy and think in terms of recycling materials now discarded as waste as pointed out by the Ontario Advisory Committee on Energy.

"Recycling waste materials and support by the public through giving preference to products made from post-consumer waste," said the ACE report, "can substantially reduce the volume of solid wastes and conserve both energy and the basic materials."

Hydro plans to increase its heavy water production to 3,200 tons a year from the 800-ton-a-year capability of the existing Bruce plant.



As well, we will need more rapid transit, better ways of moving goods, more efficient cars and appliances, and improved methods of storing energy.

Electricity is expected to play an increasingly important role in transportation, pollution control and recycling. A federal government energy study predicts that electric energy could provide 90 per cent of all energy needs in Canada by the year 2050.

World energy shortages indicate that we live in a finite, interdependent world with limited resources and we must plan carefully for the future. Most importantly, we must conserve resources that took many thousands of years to form and are non-renewable.

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